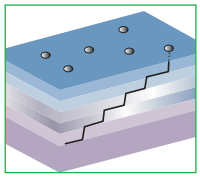
TECHNOLOGY APPLICATIONS PROGRAM

Linking American Businesses to Missile Defense Technology

ELECTRONIC AND PHOTONIC MATERIALS

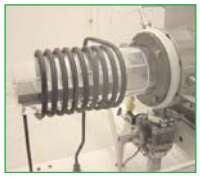


Amberwave Systems Corporation (Salem, NH)
SiGe Interlayer Buffer
Patented chemical-mechanical polishing techniques combine silicon with germanium and gallium arsenide, all on a single wafer.

Anvik Corporation (Hawthorne, NY)
Large-Area Flexible Substrate Lithography
The lithography mask and substrate scan in unison; a hexagonal scanning technique eliminates stitching errors and step-and-repeat imaging techniques.

Cermet, Inc. (Atlanta, GA)
Zinc Oxide Wafers
A proprietary technique keeps conductive ZnO crystals whole throughout a melting and crystallizing process that would normally disassociate the two elements.

Cree, Inc. (Durham, NC)
Silicon Carbide
The unique characteristics of SiC, including its ability to function well at high power and high temperature, make it well suited for use in blue laser diodes.



Crystal IS, Inc. (Latham, NY)
Aluminum Nitride
AlN substrate offers high thermal conductivity and low thermal expansion mismatch with GaN, virtually eliminating cracks that form between epitaxial GaN and today's substrates during cooling.

Find out more at: http://ww.mdatechnology.net

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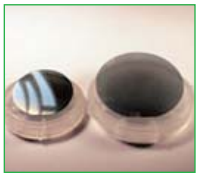
ELECTRONIC AND PHOTONIC MATERIALS

Essential Research, Inc. (Cleveland, OH)
Gallium Arsenide Wafers
GaAs has superior optical properties to those of silicon. ERI is applying its experience in manufacture of GaAs for the creation of optoelectronic devices.

RF Micro Devices (Charlotte, NC)
Gallium Nitride
The specialized manufacture of epitaxial wafers of GaN-on-sapphire and GaN-on-silicon carbide (SiC) will permit the creation of high-electron mobility transistors for power amplifiers with higher frequency and superior power performance.

Sensor Electronic Technology, Inc. (Latham, NY)
Aluminum Indium Gallium Nitride
Using a patent-pending process of pulsed atomic layer epitaxy, the company is fabricating this material into metal-oxide semiconducting heterostructure field effect transistors.



Technologies and Devices International, Inc. (Gaithersburg, MD)
Hydride Vapor Phase Epitaxy (HVPE)
HVPE is a more cost-effective deposition process than metal organic chemical vapor deposition, which is commonly used in GaN growth.

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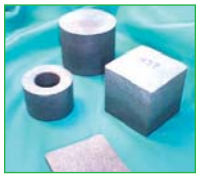
METALS, ALLOYS, AND INORGANICS



Ceracom, Inc. (Chelmsford, MA)

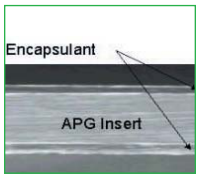
Ceramight™

A refractory metal composite that competes favorably with other materials in terms of cost, strength, and heat and corrosion resistance, Ceramight™ is 10-times stronger than columbium at 2,350°F, and 20-times stronger than tungsten at 4,000°F.

Inovati (Santa Barbara, CA)

Kinetic Energetic Metallization (KEM)

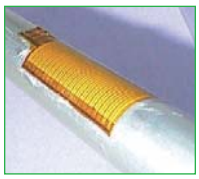
KEM is a novel solid-state directed spray process that creates superior wear and corrosion-resistant metal coatings. It is an environmentally sound alternative to electroplating and cost-competitive with traditional thermal spray processes.



kTechnology Corporation (Fort Washington, PA)

k-Core™

This is a patented thermal material system exemplified by carbon fiber composite encapsulant providing stiffness, conductivity, low outgassing, and low coefficient of thermal expansion, while annealed pyrolytic graphite provides in-plane conductivity.



Midé Technology Corporation (Medford, MA)

Laser-Based Machining

An Nd:YAG laser for the purpose of making material cuts on a ceramic surface to less than 0.002 inches produces flexible ceramics with complex geometric shapes.

Metal Matrix Cast Composites, Inc. (Waltham, MA)

Discontinuous Graphite Fiber Reinforced Metal Alloys

This is a proprietary method of producing alloys with controlled orientations to achieve the high thermal conductivity and precisely controlled thermal expansion required for electronic systems.

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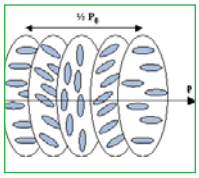
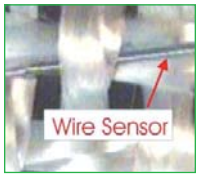


Reveo, Inc. (Elmsford, NY)

Multilayered Microstructured Film

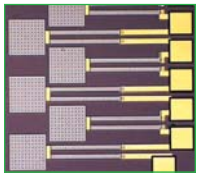
Multilayered film can be made from cholesteric liquid crystal (CLC) materials or from inorganic materials that are structured to mimic CLCs. The use of selective reflectance and polarization allows parallel reading of optical decks.



Sensortex, Inc. (Kennett Square, PA)

Magstrain™

A 10-micron film of nickel/iron coating on a 75- to 125-micron copper wire provides real-time, continuous structural monitoring data when embedded in any structure or composite and excited by an alternating current at 50 to 500 milliamperes,



TiNi Alloy Company (San Leandro, CA)

Thin-film Shape Memory Alloy

Sputtering techniques deposit a layer of hafnium-titanium-nickel alloy onto a polished silicon substrate. This thin film can then be micromachined using photolithography and selective etching techniques.

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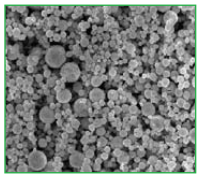
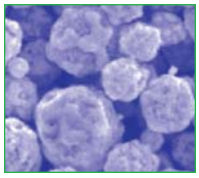
NANOPOWDERS

AP Materials, Inc. (St. Louis, MO)
Sodium/Halide Flame and Encapsulation (SFE)
The SFE process encapsulates nanoscale particles during the aerosol growth stage, protecting them from oxidation or hydrolysis to maintain purity. The SFE process can also be used to control the size, shape, and connectivity of the nanoparticles.

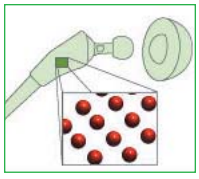
MicroCoating Technologies, Inc. (Atlanta, GA)
Combustion Chemical Vapor Deposition (CCVD)
CCVD is a patented process enabling easy synthesis of complex oxide powders with high purity, good control of particle size, high yield, and low cost production. MCT can make 6- to 30-micron powders with a yield approaching 95 percent in research quantities.



Nanochem Research, Inc. (Albuquerque, NM)
Spray Pyrolysis Powder Process
This proprietary process enables manufacture of various materials including metal/metal oxide (M/MOx) powders in spherical shapes, from 0.01 microns to 5 microns in size, with excellent uniformity, and improved particle density and surface properties.



NanoPowder Enterprises, Inc. (Piscataway, NJ)
Combustion Flame-Chemical Vapor Condensation (CF-CVC)
A proprietary process combines a vaporized metal-organic precursor compound with an oxygen-containing combustion gas, which is then ignited in a low-pressure reaction chamber and heated to provide a continuous stream of nanoparticle clusters.



NanoProducts Corporation (Longmont, CO)
Two-Stage Thermal Cooled Plasma Process
Carefully chosen precursors and a proprietary base comprise a liquid solution, which, in the presence of a plasma, forms a high-temperature vapor that is then cooled. The process has been fully scaled to produce nanoscale materials in tons-per-year quantities.

UTRON, Inc. (Manassas, VA)
Pulsed Plasma Atomization
Pulsed, high-pressure capillary discharge powered by electric arcing condenses atomized particles into nearly perfect spherical shapes. High momentum flux provides a yield of 30 percent or more.

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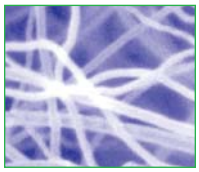
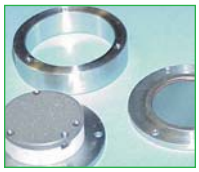
NANOTECHNOLOGY

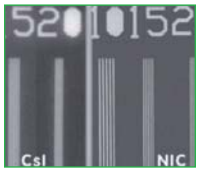


Applied Sciences, Inc. (Cedarville, OH)
Vapor-Grown Carbon Fiber
The vapor-grown carbon fiber process enables low-cost, high-volume production of carbon nanofibers. A subsidiary of ASI, Pyrograf Products, Inc., produces 35 tons per year of carbon nanofiber called Pyrograf®-III.

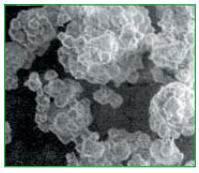


Busek Company, Inc. (Natick, MA)
Carbon Nanotube Field Emission Cathode
Field emission cathodes (FECs) are based on carbon nanotubes produced using a proprietary process. Because Busek FECs are cold emitting, they do not require a heat source.

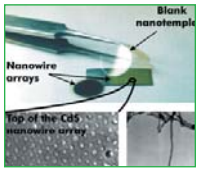
Luna Innovations, Inc. (Blacksburg, VA)
Metallofullerenes
Rare earth metals, such as gadolinium and a few group 3B elements, can be incorporated inside a carbon cage. Luna is producing highly stable trimetaspheres with high yields leading to a wide array of applications.



Nanocrystals Technology, LP (Briarcliff Manor, NY)
Nanophosphors
Doped nanocrystalline phosphors in the size range of 2 to 5 nm are used to create a high-resolution, high-contrast microchannel nanophosphor (MCNP) grid-screen, enabling high-resolution imaging with reduced radiation dosage.



Nanomat, Inc. (North Huntingdon, PA)
High-Purity Gamma Aluminum Oxynitride
Mechanochemical synthesis of high-purity AlON is a proprietary and scalable process that is cost-effective and less prone to contamination than existing carbothermal processes.



Nanomaterials Research Corporation (Longmont, CO)
Nanowire Arrays
By electrochemical deposition, a variety of Class II-VI and IV-VI binary and ternary semiconductors are grown in the pores of a nanotemplate. High-aspect-ratio packaged quantum wires can be integrated into devices or separated for individual use.

NanoSonic, Inc. (Blacksburg, VA)
Electrostatic Self-Assembly of Nanoparticles
Electrostatic self-assembly produces thin films with material properties that can be precisely controlled. The synthesis can be performed at room temperature, is environmentally benign, and can be accomplished on a variety of substrate materials.

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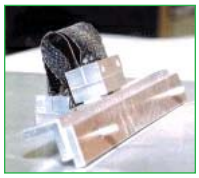
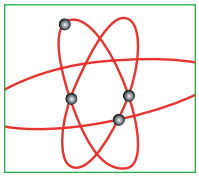
POLYMERS AND BIOMATERIALS



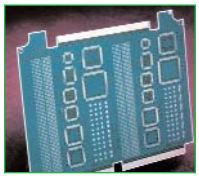
Composite Technology Development, Inc. (Lafayette, CO)
Elastic Memory Composite (EMC)
EMC is a thermally activated smart material that can be heated, deformed, and then cooled to maintain a new shape. EMC is lighter than shape memory alloy but delivers more force than shape memory plastic.



Lithium Power Technologies, Inc. (Manvel, TX)
High Energy Density Metallized Film Capacitors
Novel copolymers that include polyvinylidene fluoride (PVDF) comprise a thin-film capacitor with an energy density exceeding ten Joules per cubic centimeter.

Mississippi Polymer Technologies, Inc. (Bay St. Louis, MS)
Parmax® Self-Reinforced Polymers
Self-reinforced polymers—needing no added fiber for structural reinforcement—are two to four times stiffer than and two to three times stronger than any other thermoplastic.

Sigma Technologies International, Inc. (Tucson, AZ)
Aluminum/Polymer Composite Material
A patented vapor deposition technique lays down alternating layers of pure aluminum and an acrylate-based polymer to create an aluminum/polymer composite material called a nanolaminate.



Superex Polymers, Inc. (Waltham, MA)
Liquid Crystal Polymers
These ordered polymers have many favorable mechanical properties including a specific strength and modulus twice that of aluminum, with applications ranging from food packaging to aircraft structures.

TPL, Inc. (Albuquerque, NM)
Insulating Polymer Used in Thin-Film Capacitors
An insulating polymer with a dielectric constant of 8.0 is useful for thin-film capacitors that can deliver extremely short, very strong bursts of power.

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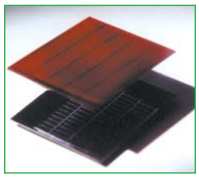
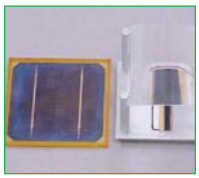
PHOTOVOLTAICS AND THERMO-PHOTOVOLTAICS



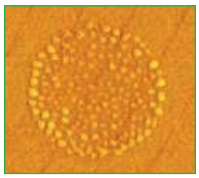
AstroPower, Inc. (Newark, DE)
Solar Cells on Flexible Substrates
Thin-film polycrystalline silicon deposited on graphite fabric reduces the weight of a solar cell, and the material is stronger and more flexible than thinned silicon wafers.

DayStar Technologies, Inc. (Grass Valley, CA)
Copper-Indium-Gallium-Diselenide (CIGS) Thin-Film on Metal Foil
A polycrystalline CIGS heterojunction solar cell sandwiches a 1.5 to 2.5 micron-thin CIGS absorber layer between a foil substrate at the bottom and a zinc oxide window deposited at the top. DayStar has developed a proprietary in-line continuous manufacturing process to do this.

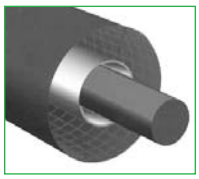
EMCORE Corporation (Albuquerque, NM)
TurboDisc™ Metal-Organic Chemical Vapor Deposition
A patented process enables the EMCORE Photovoltaics division to produce gallium arsenide solar cells that are 50 percent more efficient in light-to-power conversion and are also more radiation resistant than silicon-based solar cells.



JX Crystals, Inc. (Issaquah, WA)
Gallium Antimonide (GaSb) Thermophotovoltaics
GaSb cells absorb infrared radiation to produce current and can be mechanically stacked underneath cells that are transparent to the longer wavelengths such as indium gallium phosphide/gallium arsenide cells for an extra efficiency boost.



Luna Innovations (Blacksburg, VA)
Ionically Self-Assembled Monolayer (ISAM) Process
The ISAM process does not require expensive vacuum-based equipment used to make silicon and other semiconductor-based solar cells, and as a result ISAM production costs should be dramatically lower.



Structured Materials Industries (Piscataway, NJ)
Metal Organic Chemical Vapor Deposition of (InGaAsSb/GaSb) Thermophotovoltaics
The process of growing InGaAsSb/GaSb thermophotovoltaic crystals by means of metal organic chemical vapor deposition is less expensive than using molecular beam epitaxy.

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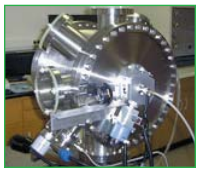
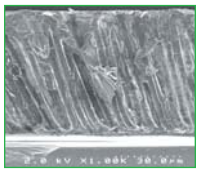
SURFACES, INTERFACES, AND MEMBRANES



AMBP Tech Corporation (Amherst, NY)
Laser-Assisted Molecular-Beam Deposition (LAMBD)
The LAMBD method can be used to create uniform, high-purity, complex thin films of carbides, nitrides, and metal alloys from 50 angstroms to 10 microns with very flat morphologies.

Applied Thin Films, Inc. (Evanston, IL)
Cerablak™
A patented high-temperature amorphous oxide material applies easily as a micron-thin coating upon a substrate, withstands temperatures up to 1200°C without crystallizing or degrading, and provides a smooth, hermetic seal.

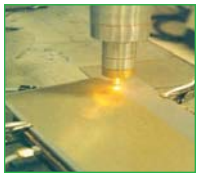


***btech*corp (Longmont, CO)**
Advanced Thermal Transfer Adhesive (ATTA)
ATTA® combines the thermal conductivity of solder with the process-friendliness of epoxy; its lower curing temperature avoids damage caused by the difference in coefficient of thermal expansion between two different materials.

Brewer Science, Inc. (Rolla, MO)
Bottom Antireflective Coating (BARC)
Specially formulated to absorb 193 nm wavelength light, when applied to the substrate this BARC will lower reflectance back into the photoresist to less than one percent and will allow linewidths as small as 0.08 microns.

IntraMicron, Inc. (Birmingham, AL)
High-Surface-Area Carbon-Metal Fibers
Proprietary techniques combine high-surface-area carbon fibers with various metals to obtain preferred chemical and electrical properties within a composite matrix.

Jet Process Corporation (New Haven, CT)
Jet Vapor Deposition™
A patented deposition process uses sonic jets to produce thin and thick films of almost unlimited chemical composition, with deposition rates up to 1 µm per minute over a 1,000 cm^2 area, and material conversion efficiency of 90 percent.



Surface Treatment Technologies, Inc. (Baltimore, MD)
Laser Induced Surface Improvement
Patented equipment uses a laser beam, thermally uniform across its width, to produce even melting of metal powder upon a substrate to a depth of up to one millimeter.

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